Variations in oil palm (Elaeis guineensis Jacq.) progeny response to high aluminium concentrations in solution culture.

ABSTRACT

Aluminium (Al) phytotoxicity is an important soil constraint that limits crop yield. The objectives of this study were to investigate how growth, physiology, nutrient content and organic acid concentration is affected by Al, and to assess the degree of Al tolerance in different oil palm progeny (OPP). Four OPPs ['A' (Angola dura × Angola dura), 'B' (Nigerian dura × Nigerian dura), 'C' (Deli dura × AVROS pisifera) and 'D' (Deli dura × Dumpy AVROS pisifera)] were grown in different Al concentrations (0, 100 and 200 µm) in aerated Hoagland solution, pH 4.4, for 80 days. We observed a severe reduction (57.5%) in shoot dry weight, and root tips were reduced by 46.5% in 200 µm Al. In 'B' and 'C', the majority of macro- and micronutrients in plants were reduced significantly by 200 µm Al, with Mg being lowered by more than 50% in roots and shoots. The 200 µm Al treatment resulted in a 56.50% reduction in total leaf area, a 20% reduction in net photosynthesis and a 17% reduction in SPAD chlorophyll value in the third leaf. Root tips (0-5 mm) showed a significant increase in oxalic acid content with increasing Al concentration (~ 5.86-fold); progeny 'A' had the highest concentration of oxalic acid. There was a significant interaction between Al concentration × OPP on total leaf number, root volume, lateral root length, Mg and K in root and shoot tissues, and Ca and N in shoots. The OPPs could be ranked in their tolerance to Al as: 'A' > 'D' > 'B' > 'C'.

Keyword: Elaeis guineensis; Oxalic acid; Photosynthesis; SPAD chlorophyll value.